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XIII.—*On the Sense of Smell possessed by Birds.*

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(Plate I.)

PART I. Evidence opposed to a sense of smell.

PART II. Evidence in favour of it.

PART III. The writer's conclusions.

### PART I.

*The Theory of Scent.*—There are certain things in the realms of Ornithology which commonly pass as instinct for want of a better name, but which really are a recognisable part of a bird's economy; yet these phases to which I allude are natural enough, being merely due to the normal employment of one or other of the senses—seeing, hearing, tasting, touching, smelling. All are at times rather incomprehensible, but the most perplexing is the capacity for scent,—alleged by some, denied by others. So far, discussion on this vexed question has been rather desultory, with the result that it has always ended in very little. The most experienced enquirers are left in a state of uncertainty as to whether birds find their food and shun their

enemies by power of smell, or by sight, or, as some suppose, by a nameless faculty unknown to human beings. It is curious that so important a matter should be still unsettled, but there are many other problems in Natural History equally obscure which will have to be solved before the economy of animal life is fully understood.

When comparing one branch of the Animal Kingdom with another, it is often the custom (although not always a safe one) to reason by analogy that such and such a property is possessed in degree by all vertebrates or by none. If we argue thus, and compare birds with mammals and other animate creatures which are endowed with scent, it seems reasonable to suppose that they also should be similarly favoured with the possession of an organ of such great utility. Of the existence of a highly-developed scent in the mammals there can be no shadow of doubt; all competent sportsmen and naturalists alike admit its presence in deer and carnivorous animals in the highest degree. That fishes possess the sense of smell has long been suspected, and is now fully acknowledged\*. Butterflies and moths, or at all events some of them, are credited with the enjoyment of the faculty of scent, or something which answers to it, of which many instances have already been published. Enough, therefore, has been advanced to show the probability of birds having scent of some kind, but before entering upon the subject, it will be judicious to clear the way by considering the three kindred senses of sight, hearing, and touch, all of which are faculties very liable to be confounded with scent, and which have been repeatedly confused with it.

To begin with sight, it is at once evident that it is impossible to form an adequate conception of the acuteness of vision which birds possess if we merely take our own faculty as a standard of comparison. Most certainly the sense of sight in man is little more than rudimentary when compared with its development in birds. A thousand examples occur to the mind immediately. What shall we say can be more

\* See Sheldon on the Dog-fish. 'Journal of Experimental Zoology,' 1911, p. 61.

marvellous than the stoop of a Falcon (*Falco peregrinus*) on its prey, or the sharp vision of the Great Grey Shrike (*Lanius excubitor*), sometimes used in Holland for trapping Falcons, and able to descry them at an incredible distance? But there are many birds besides Shrikes which can detect an enemy soaring so high in the heavens that to the human eye it is invisible, or only just within the extreme range of a telescope. Another factor is that many—possibly most—birds are provided with an extraordinarily delicate sense of hearing, which, although it may not help in finding food, is constantly warning them of danger. Again, the investigator has to be cautious not to confuse the organ of scent with that of touch, by means of which some birds feed—*e. g.*, the Woodcock, most of the surface-feeding Ducks, and (in part) the Apteryx. Thus it will be seen what an involved business it is for an experimenter to formulate any trial which appeals to a bird's sense of smell, and which at the same time excludes sight, hearing, and touch.

If a bird smells food or scents the presence of enemies, it does so by means of the olfactory nerve, for it is by this small and delicate instrument, which passes from the nostrils to the brain where it terminates in a bulb, that impressions of odorous particles are conveyed. Chemical research tells us that the agents which act upon this nerve, and thus give rise to smell, are particles of effluvia, but of the extremest tenuity, which animals can pick up with far greater celerity than man.

Unfortunately my knowledge of anatomy is of the smallest, but Mr. R. H. Burne, who has been good enough to take an interest in the present enquiry, has most kindly obliged me with a photograph (Pl. I. figs. 1, 1a) of a section of an Eagle's (*Aquila*) head, which is preserved in the Museum of the Royal College of Surgeons (Physiol. Series, No. E 119). This is a help, and explanatory as showing in detail the normal structure of the nose, olfactory bulb, and nerve; the left bulb and root of the left nerve are exhibited, and the right nerve with its passage into the olfactory eminence in the nose cavity. With this to aid, the position

of the parts and their purpose is more easily understood than by mere description.

*Dissentients from the Scenting Theory.*—I am not sanguine enough to suppose that the facts and opinions brought together in this short paper will settle the scent question, but I hope they may advance it a step or two; with this in view it will be convenient to begin by enumerating some of those who have dissented from the scent theory in the past on various grounds, and whose considered opinions are by no means to be at once rejected.

The names of naturalists opposed to the scent theory are as follows:—First stands that of the bird-painter, John James Audubon, who had the support of his friend Bachman, and later (in 1836) the complete concurrence of William Swainson. Between Audubon and a clever but eccentric Englishman, Charles Waterton, a heated controversy on this vexed question presently sprang up, but the arguments advanced with much warmth are not very convincing, and in reading them one is inclined to smile at the jealousy of the disputants and their resort to personalities\*.

#### THE DISSENTIENTS.

In 1829 Audubon was opposed to the scent theory.<sup>1</sup>

„ 1837 Macgillivray (with reservation).<sup>2</sup>

„ 1875 H. E. Dresser do.<sup>3</sup>

„ 1884 Elliott Coues.<sup>4</sup>

„ 1893 Lord Lilford.<sup>5</sup>

<sup>1</sup> Jameson's Journal, No. iii., and the 'Ornithological Biography' (ii. p. 33).

<sup>2</sup> 'History of British Birds' (i. pp. 51, 507).

<sup>3</sup> 'The Birds of Europe' (iv. p. 573).

<sup>4</sup> 'North American Birds,' p. 178, and 'Field and General Ornithology,' p. 263.

<sup>5</sup> 'The Birds of Northamptonshire,' p. 356.

\* The major part of this literary duel was carried on in Loudon's 'Magazine of Natural History' for 1833 and 1834. See vol. iii. p. 449; vol. v. p. 233; vol. vi. pp. 83, 163; and vol. vii. pp. 66, 164, 276. An amusing article in Waterton's 'Essays on Natural History' entitled "The Vulture's Nose" will repay reading, as well as two other papers on the same subject.

- In 1905 F. R. Herrick.<sup>6</sup>  
 ,, 1905 F. Guillemard.<sup>7</sup>  
 ,, 1907 C. W. Beebe.<sup>8</sup>  
 ,, 1912 Abel Chapman (with reservations).<sup>9</sup>  
 ,, 1912 J. E. Kelso do.<sup>10</sup>

<sup>6</sup> 'Home Life of Wild Birds,' p. 6.

<sup>7</sup> 'Nature,' February 2, 1905.

<sup>8</sup> 'The Bird' and 'Bulletin of the New York Zoological Society,' 1909, part ii. p. 465.

<sup>9</sup> 'The Field,' January 1912.

<sup>10</sup> 'Common and Rare British Birds,' p. 330.

These authors, and it will be recognised that there are some names of good standing, must all be ranged on the opposition side in the question of "Scent" *versus* "No Scent." Indeed, two of them who may well rank as experts, Elliott Coues and Lord Lilford, are in the most distinct opposition to the theory. Lord Lilford, who, when he was alive, was looked upon as a safe exponent of bird-life, expresses himself very strongly as a disbeliever in the employment of scent by the majority of birds, and adduces his experience as a gunner of many years.

*The views of modern Ornithologists, and the futility of their experiments up to the present.*—It will be seen, therefore, that in the past the non-scent advocates have been in the majority. At the same time, it is quite plain that it is not with the disbelievers that the *onus probandi* rests, but with the upholders of the scenting theory. First of all, let us test the matter by the opinion of some of those more recent writers who have approached the question without the bias which marked the Audubon-Waterton wrangle, and whose views are more likely to be sound. First, Mr. Abel Chapman, a competent ornithologist, who follows in the line of Lord Lilford—that is to say he is opposed to the idea of birds, with the exception of the *Anseres*, being able to scent either food or foe to any considerable extent\*.

On the question of Ducks (*Anseres*) there is a good deal to be said, and this part of the subject will be returned to

\* "The Sense of Smell in Birds" (Field, Dec. 30, 1911, and Jan. 6, 1912). In preparing these articles Mr. Chapman acknowledges the assistance of Mr. J. E. Harting.

later, but there is no need to withhold the experience of one of the best-versed Norfolk wildfowlers, James Vincent. Mr. Vincent has long since satisfied himself that on the large Broads, diving ducks, such as the Tufted Duck (*Fuligula cristata*) and Pochard (*F. ferina*), are easily approached down wind with a man's scent blowing to them, and Coots also, but he is careful to add that this does not apply to Mallard and Teal.

Mr. Chapman goes on to say something about African Guinea-fowl (*Numida*), adding as the result of his experience in lying up for these birds as well as for Sand-Grouse (*Pterocles*) and Francolin, which he had often done, that none of them ever gave the least indication of detecting the human presence by their nostrils. It is true this is but negative evidence, but it is confirmed by Stevenson-Hamilton\*, another African sportsman, and coming from two practical men it can hardly be set aside. Mr. Chapman does not allow the olfactory organ to be a safeguard to any Game-birds, but here he is in direct opposition to Xavier Raspail, whose evidence will come later (1) †. The circumstances under which their observations were made may account for a good deal of difference. As regards other groups of birds, the evidence is in many cases conflicting; but certainly there are some species which, so far as can be judged, exhibit no powers of scent at all.

With the great family of waders—Curlew, Godwits, Dotterel, Knots, Plover, &c.—it is difficult to say whether they do or do not scent the presence of danger, for most of these birds are so much on the alert at all times, and have marvellous sight and hearing. Mr. Chapman makes a curious remark about the Curlew (*Numenius arquata*), viz., that while on the inland moors of Northumberland, its scenting capacity is, or seems to be, negligible, on the coast it quickly becomes keenly sensitive. In this connection, the views of Dr. F. G. Penrose ‡ and Mr. J. E.

\* 'Animal Life in Africa,' p. 290.

† See bibliography at the end of the paper.

‡ 'British Birds,' vi. p. 266.

Kelso\* as to the behaviour of Stone-Curlew, and of Mr. Leslie Smith on the Ringed Plover †, are all certainly worth consulting, though too long to quote, but they have more than an indirect bearing on the scent question.

All the numerous small birds (*Insectores*) may have need of scent at times, and possibly they enjoy and employ it. Raspail thought that it was present in *Turdus* (1), and at least one writer credits the Cuckoo with it, but the Cuckoo is a bird of mystery about which anything may be suspected! As for Jays, Shrikes, Nightjars, &c., for the present it is safest to say that we know nothing about their olfactory resources, if they have any. Titmice (*Parus major*, *P. caeruleus*) may possess scent: Raspail thought they had it (1), and certainly their visits to dairies which a hundred and thirty years ago won them the name of "Pickcheese" in Norfolk, looks very much like it.

*Tests applied to Turkeys and Doves.*—Some, perhaps, may think that the scent question might be settled by artificial experiment, but this is very difficult. As a matter of fact, not a few tests have been applied from time to time, but none of these so-called trials have been very successful. A few years ago the domestic Turkey (*Meleagris*) was laid under contribution. Owen had shown that, like other birds, it possessed the usual olfactory nerves ‡, and Dr. Alexander Hill deemed it a convenient medium for experimenting on. Shortly the details of the tests applied by that gentleman, which he communicated to 'Nature,' were as follows §:—Dr. Hill placed various strong-smelling substances, such as asafoetida, essence of anise, and oil of lavender, in the turkeys' food in one place, and nothing at all in another, in the expectation that the turkeys would hardly show themselves insensible to such powerful odours: but either the turkeys were too greedy or very indiscriminating, for they evinced neither preference for, nor repugnance to, their

\* 'Common and Rare British Birds,' p. 330.

† 'British Birds,' xv. p. 26.

‡ P. Z. S. 1837, p. 34.

§ 'Nature,' Feb. 2, 1905.

meals. Even when prussic acid was tried, they remained quite indifferent, although it caused them to stagger under its strong fumes, so the experiments had to be abandoned as a failure.

Next a skilled anatomist of the United States, Dr. R. M. Strong, carried out an elaborate series of experiments on tame doves, the results of which, disappointing as they were, he has detailed in the 'Journal of Morphology.' The doves were placed in tight compartments, previously specially prepared either to admit or to exclude scent, when it was hoped there would be some demonstration on their part to indicate an association of odour with the location of food, but instead of that they unfortunately remained stolidly indifferent (2).

Others have supposed that experiments might be made with blind birds, and it is not unlikely that the faculty of scent comes to their aid when food is required, but I am convinced that any such trials made in aviaries are too fallacious to be of use. What is more to the point is that wild birds in which blindness was supposed to have been congenital have been occasionally shot. It is true there are not many such records, but an instance of a blind Shoveler Duck (*Spatula clypeata*) is given by Mr. Harting. "The eyes," he says, "were hard and opaque, reminding me of the appearance of a horse that is wall-eyed"\*, yet the bird was in good condition. Another case was that of a blind Shag (*Phalacrocorax graculus*) in Orkney, which had a dark film covering both eyes, and the pupils were scarcely discernible, yet it was quite fat when captured. A third was a Weaver Bird (*Ploceus baya*) which had cataract in both eyes †, and a South African Barbet which, though blind, was still able to maintain itself.

\* 'The Field,' Sept. 30, 1871.

† 'The Field,' Oct. 7 and 14, 1871. But a blind Rook was seen to be fed by other Rooks (t. c., May 20, 1905), and assistance of this kind may be sometimes forthcoming.



## PART II.

*Indications that birds are capable of scenting food.*

Having now quoted several adverse opinions about scent, and most of what there is to be said against the scent theory having been brought forward, it remains to cite several facts which tell in its favour. With this in view it is proposed to put into the witness box the Black Vulture (*Cathartes*), of which there is a great deal to say, and eight or nine other species, namely, the Raven, the Rook, the Hooded Crow, the Woodpecker, the Sandpiper, the Great Shearwater, the family of Petrels, and the Apteryx.

1. THE RAVEN.—We first meet with the notion that birds have any powers of smell in a very old belief about the Raven (*Corvus corax*). For centuries there has been a persistent idea that Ravens were gifted with the faculty of discovering the approach of death in a house where there was malignant disease, and presumably this could only be accomplished by their possessing acute scent perception, unless indeed they have some occult food-finding faculty, which has been also suspected in Vultures. Belief in the strange powers of the Raven was far from being confined to England; no great research is needed for tracing it in many other countries besides our own. In the seventeenth and eighteenth centuries, that the Raven “smells death” was a matter of common credence in Scotland, in the Shetlands, in the Isle of Man, in Ireland, in Wales, and in parts of Germany, but it did not extend much farther south than that, and seems to have had little or no currency in France and Italy. It was the popular idea in northern rather than in southern countries,—that is what the well-known lines which Shakespeare has put into the mouth of the jealous Othello in one of his most famous plays, represent :

“As doth the Raven, o’er the infected house  
Boding to all . . . . .”

*Othello*, Act iv. scene 1.

That the belief expressed by the Elizabethan poets and upheld by later writers of repute, German as well as English,

in the almost supernatural powers of Ravens was something more than idle folk-lore is certain, although at the present time it may not be easy to support that faith by anything very tangible. Nevertheless there are a few anecdotes confirmatory of the Raven's power which seem to be authentic enough, of which the following is one :—

In May 1871, Mr. E. Baker of Merse in Wiltshire was attending the funeral of two children who had died from diphtheria. The road to be followed lay along the Downs for a mile or more and the hearse had not proceeded far when two Ravens made their appearance. These sable birds, which seventy years ago were not uncommon in Wiltshire, accompanied the mourners most of the way, and attracted attention by making repeated stoops at the coffins, leaving no doubt in Mr. Baker's mind that their power of scent had detected what was inside them \*. After reading this narrative it is difficult to treat the long-established belief about Ravens as a fable ; here it is quite certain that sight could have been of no avail as the coffins were closed, and the Ravens could only have realised what their contents were by scent.

Other witnesses to their power of scent might be called, but they are not all satisfactory, so I will limit myself to four.

William Hogg of Peebleshire, sheepmaster, was a great friend of Macgillivray's, and a very observant naturalist. He tells us how, in his part of Scotland, in the early part of the nineteenth century, a sheep on the hills could not be dead many minutes before the Ravens would find it †. Nowadays there are so few Ravens left that a sheep's carcass might lie unheeded, but a hundred years ago it was different, when these fine birds had not been systematically poisoned throughout the countryside.

“ It is a common belief,” says Mrs. Saxby, writing of the folk-lore of the Shetlanders whom from long residence she

\* This singular story is told by the Rev. A. P. Morres in the ‘ Wiltshire Archaeological Magazine ’ for 1873 (vol. xviii. p. 299).

† ‘ History of British Birds,’ by W. Macgillivray, i. p. 510, and ‘ Zoologist,’ 1843, p. 216.

knew so well, "that Ravens are attracted to a house where a corpse is lying . . . . led by some subtle sense beyond the senses of mere man to comprehend" \*.

Charles St. John, another good Scotch naturalist, who lived farther north than shepherd Hogg, too careful to commit himself on the question of scent, is content with the remark that "the instinct of the Raven in discovering dead bodies of large animals is wonderful and very difficult to understand" †, but he evidently does not altogether discard the olfactory theory.

Robert Dunn considered that the Raven's acuteness must be due to scent. "It possesses the sense of smell in an exquisite degree of perfection" ‡ is his verdict, and that is what most Shetlanders seem to have thought about the Raven.

But although the Raven is so clever in discerning the whereabouts of food, observers are agreed that it displays no particular skill in the discovery of danger, if that danger be not visible and of this the present writer has had personal experience more than once. Dr. R. M. Strong, of Chicago, who has taken up the scent question from an anatomical point of view, and worked it more effectually than anyone, finds the olfactory lobes and nerves in all the Crow tribe to be surprisingly minute, which is curious. Dr. Strong's figure of the Raven's lobe exhibits this deficiency, and the same conditions prevailed in all the *Corvidæ* material at his disposal (2).

2. ROOK.—In testing the use and operation of scent, a good example to take is the Rook (*Corvus frugilegus*), and observe how one of these sagacious birds goes to work when he is hungry. The Rook does not forget that he is endowed with sharp sight, but nature teaches him to make use of his nostrils also to indicate where a meal lies, nor does it signify to him that those nostrils are often covered with bristles.

\* 'Birds of Omen in Shetland,' p. 10.

† 'Natural History and Sport in Moray,' p. 47.

‡ 'Ornithologists' Guide to Orkney and Shetland,' 1837, p. 81.

He has a power which enables him to smell through all bristles, thick or thin, and quickly to detect the fat grubs of the Cockchafer and the Click-beetle lying buried beneath the ground, especially if it be the loosened soil of a newly-turned furrow. This faculty the Rook must exercise by the help of his nose, and what proves it to be so is that he does not make his hole by chance, but in the right place where the morsel lies.

In 1916 I had evidence of this, for having sown one portion of a field with potatoes in response to the national appeal to farmers to grow this crop, I was very soon struck with the propensity of Rooks to visit that part of my farm and eat them. It is true they were pretty safe for the first four weeks, but when May came, and the "settings" began to shoot a little, the Rooks found them out. Rooks can be very troublesome also on the newly-sown barley in spring, when rows of holes made by their strong beaks are sometimes to be seen, but always be it noted, in the place where the grain lies\*. Nevertheless the instinct of the Rook may be sometimes at fault, as the following anecdote seems to show.

On June 20th, 1920, the farm labourers at Keswick were set to "single" swede-turnips, which were already about four inches high. They left off chopping them out at noon for dinner, and to go into a hay field on another part of the farm, returning to the roots about 6 A.M. on the following morning. In the meanwhile a very large flock of Rooks had settled on the field, and observing the freshly-hoed plants, perhaps concluded from their drooping appearance that they were attacked by the larvæ of *Agriotes lineatus*, i. e. "wireworms." At all events, they completely destroyed two acres of the crop of swedes by pulling up the young plants and leaving them to die—in fact, doing me over twenty pounds worth of damage in less than eight hours. If, then, my interpretation of this performance be the right one, it is not a proof of scent, but quite the reverse on the part of Rooks.

\* They may, however, be balked by cross-harrowing, which makes the grain lie deeper.

3. HOODED CROW (*Corvus cornix*).—This Crow is common enough near the coast, always looking for garbage or what he can find. After a day's covert shooting especially he is sure to be on the alert. Again and again will this crafty bird make a meal on some hare or wounded pheasant, which the gamekeeper and his beaters could not discover. However thick, writes a well-known shooter on the Norfolk Broads (James Vincent), the sedge or reeds into which ducks or coots fall, the Hooded Crow will find them, when a retriever is unable to scent anything whatever.

4. WOODPECKER.—The Greater Spotted Woodpecker (*Dryobates major*) is very fond of the caterpillars of the Wood Leopard Moth (*Zeuzera asculi*), which bore tunnels into oak, ash, beech, lime and chestnut. The Woodpecker is therefore doing good by destroying them, but in what way does it discover the larvæ if not by scent?

The same inference must be drawn from the behaviour of American Woodpeckers, some of which, says a naturalist in that country (Mr. Beal), locate their hidden prey, larvæ and grubs, "with great accuracy and often cut small holes directly to the burrows of the grubs" (3). This certainty of discovery would be strange if it were not explainable by scent, which seems to be the right solution, though possibly the borings of the larvæ are at times audible.

"I have seen," says Mr. F. M. Chapman, "an opening made by a Pileated Woodpecker (*Phlœotomus pileatus*) in a white pine-tree, twelve inches long, four inches wide and eight inches deep, through perfectly sound wood, to reach the larvæ at work in the heart of the tree"\*. A food-finding faculty of some kind must exist in these Woodpeckers, perhaps scent, possibly hearing, but in any case not sight.

5. SANDPIPER.—It is a common practice in Norfolk to "fye out" a drain, that is, to cleanse a "dyke" or pasture water-course, and a very smelly operation it sometimes is. Again and again have I remarked how the attraction of the mud is sure to bring sooner or later the Green Sandpiper

\* 'Colour key to North American Birds,' p. 148.

(*Tringa ochropus*), by no means an abundant bird at any time, and occasionally *T. glareola* or *T. hypoleuca*. But how do they manage to discover the freshly-turned mire which is to provide them with a meal unless they smell it, and if they smell it, it must often be from a great distance, yet of course there is the possibility that they may see it when on the wing at night. But although Green Sandpipers may find a muddy pond by smell, when they have got there they seem to probe for their food by touch.

6. SHEARWATER AND PETREL.—No more convincing proof has been published of there being certain sea-birds which scent their food than the testimony borne by Captain J. W. Collins in his narrative of the methods employed by the New England fishermen in catching Petrels for bait off Newfoundland and Nova Scotia.

Collins confidently affirms that the Great Shearwater (*Puffinus gravis*), Leach's Petrel (*Oceanodroma leucorhoa*), and Wilson's Petrel (*Oceanites oceanicus*) are all able to discover—apparently by smell—liver at a distance, and, moreover, they can do it in a thick mist when sight would not avail them. "On many occasions during the prevalence of a dense fog, when not a bird of any kind has been seen for hours," he writes, "I have thrown out as an experiment pieces of liver to ascertain if any birds could be attracted to the side of the vessel. As the particles of liver floated away, going slowly astern of the schooner, only a short time would pass before either a Mother-Carey Chicken or a Hag\*, generally the former, could be seen coming up from the leeward out of the fog, flying backward and forward across the vessel's wake, seemingly working up the scent until the floating pieces of liver were reached" (4).

7. STORM PETREL.—On 10 October, 1867, a skate's liver was floating near the pier at Brighton, which attracted several Storm Petrels (*Thalassidroma pelagica*) †, but what brought them, if not the odour of the liver, for they are not common birds in that part of the Channel?

\* Hag or "Hagdon," the Greater Shearwater (*Puffinus gravis*).

† 'Land and Water,' 19 Oct., 1867.

It would seem from other suggestive, if not conclusive, observations, that the attribute of scent belongs to the northern Fulmar, the Blue Prions of the south, and possibly to most species having tubular nostrils, though whether those nostrils are an aid or not is uncertain, for their real use has never been demonstrated. Dr. C. B. Ticehurst considers that he has proved scent in *T. pelagica*\*, of which the preceding anecdote is confirmatory.

8. FULMAR PETREL (*Fulmarus glacialis*).—The Fulmar has long been credited with powers of smell, but there is no absolute proof of it, although the general sentiment among seamen is that it works by scent. Dr. Strong, in his anatomical article before referred to (2), descants at some length upon the large olfactory lobes of the Fulmar, which had been previously described by Klinckowström (5), remarking that its organs of smell were among the most interesting of any species examined, the inference being that scent in the Petrel is well developed.

9. GANNET.—There is one bird about which we should have liked more information from so competent an authority as Dr. Strong, and that is the Gannet (*Sula bassana*); in this species Dr. Strong finds the olfactory lobe to have a peculiar ventral position, but he does not hazard any opinion as to what this may indicate (2). Gannets and Cormorants have no external nostrils, which is against their possessing olfactory powers, nor does one see what good they would be to them.

10. ALBATROS.—In 1908, Mr. Burne exhibited a preparation of the head of an Albatros (*Diomedea exulans*) before the Zoological Society, for the purpose of showing the relatively enormous development of the olfactory organ in this species, in which the bulbs were found to measure 7 mm. in diameter, and to receive large nerves from the nasal septum and lateral wall of the olfactory chamber (see P. Z. S. 1908, p. 66). In Mr. Burne's opinion this must mean that the Albatros is the possessor of great powers of

\* 'Avicultural Magazine,' 1911-12, p. 113.

scent, but this is not confirmed by the observations of seafaring men, see some remarks by Captain F. W. Hutton (Ibis, 1865, p. 292).

11. VULTURE.—So far back as the days of Ray and Willughby, it was the universal opinion of educated men that Vultures were to be credited with great powers of scent. The first man to cast doubt on this common report, and to investigate for himself, was the American naturalist Audubon, who entirely discredited any olfactory power whatever being granted to the Vultures of North America; so did all the leading naturalists of Europe, but not Charles Darwin, who, however, admitted that the obtainable evidence for and against was singularly balanced\*. The tests used by Audubon, which were thought so much of at the time that they were held by Percival Hunter to be unanswerable †, are described at length in 'Jameson's Edinburgh New Philosophical Journal' (October and December 1826, No. 3); Loudon's 'Magazine of Natural History' (1834); and in the 'Biography of the Birds of America.' They are not what would be thought very convincing now, in spite of the high opinion entertained of them by eminent men of that day, and before long they became the object of scathing criticism from a clever writer and controversialist, Charles Waterton, who maintained, as a result of personal acquaintance with Vultures in Guiana, that the Black Vulture (*Cathartes atrata*) was directed to its food by scent ‡. Strange to say, the Vulture question still remains almost as much a puzzle as it was a hundred years ago, and the Audubon-Waterton "duel" is not fought out yet!

There are not a few who still continue to look upon scent in Vultures as an untenable theory; apparently that view was held not so very long ago at the Natural History Museum—in fact, as recently as 1910, so careful a naturalist as Mr. W. P. Pycraft sided with the non-scent party. With so much divergence of opinion, all we can do is to

\* 'A Naturalist's Voyage,' p. 184.

† 'Magazine of Natural History,' 1833, p. 84.

‡ *Ibid.*, 1832, p. 240.



formulate the evidence and leave future enquirers to pass judgment.

The most important pro-scent witness to be called is a medical man in Jamaica, apparently very trustworthy, Mr. W. Sells, by whom the following communication was made to the Zoological Society\*.

After premising that on one occasion he had to make a post-mortem on a body, and whilst so engaged the roof of the house was studded with Vultures (*Cathartes aura* † and *C. atrata*), he goes on to tell the following:—"Another instance was that of an old patient and much valued friend who died at midnight. The family had to send for necessaries for the funeral to Spanish Town, distant thirty miles, so that interment could not take place until noon of the second day, or thirty-six hours after his decease, long before which time—and a most painful sight it was—the ridge of the shingled roof of his house, a large mansion of but one floor, had a number of these melancholy-looking heralds of death perched thereon, besides many more which had settled in trees in its immediate vicinity. In these cases the birds must have been directed by smell alone, as sight was totally out of the question."

Mr. S. R. H. Rhoads, another reliable observer, relates an incident which, though not quite similar to the above, leads to exactly the same inference ‡. A horse and cow had been buried in a certain place, where they lay some years, but on the top soil being removed for potatoes, although the carcasses were invisible and the arising odour imperceptible to human nostrils, Vultures were soon attracted to the spot. Several other cases might be cited, but the above seem to be the most trustworthy.

Now to turn from America to the Vultures of South Africa (*Gyps kolbii*, *G. rueppelli*, *G. auricularis*, *Neophron perenopterus*), for a great deal has been said and written

\* See P. Z. S. 1837, pt. v. p. 33.

† Called "Turkey-Buzzard," and the Black Vulture sometimes nicknamed a Carrion Crow.

‡ 'The American Naturalist,' xvii. 1883, p. 829.

about them and their capacity, but if we may trust the evidence before us, they are altogether different from the American Vultures, the sense of scent being non-existent.

In his entertaining 'Animal Life in Africa,' Major Stevenson-Hamilton says:—"After two occasions on which I had happened to shoot crocodiles basking on sand-banks, stone dead with the first shot, so that they lay in perfect natural positions, I took the trouble to visit the carcasses every day in order to see what the Vultures did. On one occasion it was a week, and on the other five days, before the birds came near, though as many minutes would barely have elapsed in the case of a mammal lying obviously dead in the bush ere they put in an appearance" (p. 289).

Similar trials had been made by Dr. F. Guillemard, who tells us that when a Wildebeest (*Connochates*) was shot, disembowelled and hid in the hole of an Ant-bear, the Vultures could not find it, although a circle of them might be seen standing round the spot where the offal had been thrown\*.

The same view of the matter is taken by other African writers, *e. g.* by Sir John Kirk (Ibis; 1864, p. 314) and Mr. W. L. Selater (Birds of South Africa, iii. p. 386).

But it is not only in Africa that the sight theory is predominant. It is adopted in preference to that of scent by naturalists in Asia, although it is true that in India writers are not unanimous about it. India is a country of Vultures, and Indian sportsmen when they shoot a deer consider it safe if covered up, but if it is exposed it will probably be eaten by Vultures. T. C. Jerdon, however, more cautious than some, thought that Vultures must have "a strong sense of smell," although in another place he says it has been exaggerated, and in any case he realises their acuteness of eyesight. He is here alluding to *Gyps fulvus*, *G. himalayensis*, *G. indicus*, and *G. tenuirostris* †.

After all, it may be that the explanation of the uncertainty of behaviour on the part of the Vultures, and the different

\* 'Nature,' Feb. 2, 1905.

† 'Birds of India' (Austen's edn.), i. p. 5, Introd. xvii.

inferences which have been drawn from it, are not so obscure as at first appears. Possibly Vultures pick up effluvium arising from putrid matter at a distance, but not so well when it is near them; while another suggestion is that their olfactory organs are more susceptible to decay in its first stage of decomposition than later—instead of the reverse, as might be expected.

That Vultures are exclusively guided by their marvellous powers of sight, when soaring at a vast height in the heavens they discern some carcase on the ground, is admitted, and it is easy to understand how a sort of aerial telegraphy may bring them in numbers to the feast, but this is no disproof of the employment of scent at other times and under different circumstances.

12. **APTERYX.**—After perusing the foregoing accounts, it seems impossible to deny that there are some birds, at any rate, in which the sphere of perception of odours must be much more extended than it is in man; but let us turn to a very specialised New Zealand form—a bird which has already been under discussion more than once in connection with the scent question.

That the Apteryx possesses a complicated nasal apparatus has long been known. The prominences named the turbinal bones are described by anatomists as large, while the nostrils, instead of being at the base of the beak as in most birds, are placed at its extreme tip and on the under surface. From these facts, and from the length of the olfactory sacs, which extend far back, and from the sniffing sound which the bird commonly makes when searching for food, the Apteryx has been regarded by several modern authorities as possessing great scenting capacity. At the same time, that it is so is not altogether clear, because whatever its olfactory powers may be, it has unquestionably in addition an exceedingly delicate sense of touch, and we can understand how needful both these qualities must be, especially the latter, for the sight of an Apteryx is of the poorest and would be but little help in finding food.

I am greatly indebted to Mr. R. H. Burne, of the Royal

College of Surgeons, for the accompanying photograph (Pl. I. figs. 2, 2 a) of the section through the head of an Apteryx, taken from a preparation preserved in the College (No. E 112 Physiol. Series, Royal College of Surgeons Museum). This will explain the several parts better than a description. In it the position of the olfactory bulb is shown, as well as the turbinal bones in the nose-cavity covered by the olfactory membrane. Considerable evidence of the alleged powers of the Apteryx has been at different times advanced, all of which need not be quoted; indeed, some of it is not satisfactory\* and is hardly worth reproducing.

An experiment tried in London by Dr. Strong and Mr. R. I. Pocock with *Apteryx mantelli* at the Zoological Gardens, was not conclusive (2), nor was one which was detailed some years ago in 'The Field' very satisfactory, but, on the whole, there is a consensus of opinion that the Apteryx makes great use of the nasal apparatus with which nature has provided it.

*The supposed ability of Pheasants and Wild Ducks to scent water.*—By no field-naturalist has the debated question of scent been more studied than by Xavier Raspail, who argues that if birds can scent seed and grain, there is no particular reason why they should not smell water (1). In the case of a certain Pheasant's nest on his property in France, where he had carefully watched the hen, he writes:—"Il est incontestable que cette Faisane, de même que tous les Faisans mâles où femelles que j'ai vus trouver l'eau quel que soit l'endroit caché ou je l'avais placée, en avait perçu les émanations à une distance qui ne pouvait être moindre de 180 mètres (about 225 yards)" from the spot where "son nid aurait été établi sur la lisière même du bois." This, then, seems to be pretty clear.

We see the same instinctive knowledge of the whereabouts

\* See 'The Field,' 1874, p. 277. Sir Walter Buller has a good deal to say on the subject (Birds of New Zealand, 2nd ed., vol. ii. p. 313), and he returns to it in his Supplement when treating of *A. lawreyi*.

of water in pinioned wild-fowl. When they escape from my small pond, they at once make for the river, distant three-quarters of a mile, although it is certain that they can neither see nor hear it from where they are; accordingly it must be by scent, or else by some unknown faculty that they are guided. The latter solution is possibly the more probable of the two.

*That some Birds undoubtedly smell the presence of Enemies.*—Having now done with the food part of the enquiry, there is another aspect in which to consider the employment of scent by birds,—and that is, can they or can they not smell the presence of an enemy? We know very well that four-legged animals are quick enough in detecting a hunter's presence by the odour which he gives out, and what they can accomplish, birds may be expected to do also.

The experiments undertaken by Dr. Penrose, Mr. Kelso, and Mr. Leslie Smith \* it is true, do not altogether bear this theory out, but there may have been something exceptional. Xavier Raspail holds strongly that birds can and do smell the presence of human beings and probably of other enemies. In his judgment Pheasants and Partridges in France give quite as ample proof of a distrust of hidden danger as do hares, rabbits, and roedeer (1).

That M. Raspail's observations are correct few will doubt, but in England game is kept in such an artificial condition that it is not easy to form any conclusion about Pheasants. Partridges, however, seem capable of scenting danger, and several times I have thought to detect their smelling a man's presence when they did not see him, and the same also with Wood-pigeons.

Acute powers of scent have always been attributed to Wild Ducks by decoymen, both Dutch and English. I used to hear this insisted upon by old Page at Fritton Lake, and in fact all decoymen are agreed about it. It was commonly held that a perfect decoy should be provided with three "pipes," so that from whatever quarter the wind blew

\* *Antea*, p. 230.

the decoyman should have his chance, and to make doubly sure he took a piece of smouldering peat in his hand, without which the fowl might smell him and rise in a moment.

“Such is the acute sense of smelling,” writes a well-known sportsman of the old school, William Daniel (1812), “which wild-fowl possess that should the (decoy-) pond be full of fowl, if they scented a man, not a bird would remain in it a moment”\*.

The Rev. R. Lubbock, whose description of the Norfolk decoys has become a classic, goes on to aver the sense of smelling to be also very acute in the Heron (*Ardea cinerea*) (7), and this I am ready to confirm, having on different occasions observed a Heron rise from a position where it could not have seen my approach, although it is just possible that it heard me.

The evidence concerning Wild Geese (*Anser brachyrhynchus*, *A. ferus*, *A. albifrons*) is mixed. Reports from the Hebrides and the Wells marshes in Norfolk indicate that they can be very sensitive to the human presence at times, but that they are not always so. What the agency is that regulates their apprehensions is not clear, but they do not behave like Wild Ducks.

Lord William Percy mentions his giving his wind at a distance of about seventy yards to three White-fronted Geese, which were asleep in a bog. All three immediately lifted up their heads and walked about uneasily, looking in the direction whence the scent came, evidently alarmed by something †, which he naturally concluded to be a proof of their having scented him.

On the other hand, Mr. F. M. Ogilvie is more ready to attribute the alertness of Wild Geese to sight, remarking that they seem to “discern any strange object which may be a source of danger, at what seems to us quite impossible distances” (6).

*That Birds smell Eggs tainted by Human contact.*—Again,

\* ‘Rural Sports,’ iii. p. 268.

† ‘The Field,’ vol. cxix. p. 48.

how easily birds forsake their nests and eggs when too much inspected, the reason being, I take it, not so much that the fabric of the nest has been disturbed as that the eggs and nest have become tainted by contact with the human hand; this, at all events, seems to be the solution of their behaviour in a great many cases. One of the most suspicious birds appears by report to be the Great Bustard (*Otis tarda*). We know but little of its habits in England, but Lafoureaud, whose account of the Bustard is very complete, describing them in the south of France, tells his readers that if a Bustard's eggs are handled, or even touched, they are nearly certain to be forsaken (8).

The same jealousy is attributed to them by Daniel\*, and by another French sportsman M. Descourtils. "If in the absence of the female," observes the latter writer, "un touche a ses œufs, elle les abandonne, quelque avancée que soit l'incubation" (10). In these cases it can be nothing but the operation of scent which provokes the parent Bustard to forsake her treasures so easily.

### PART III.

*Conclusions on the Scent question very difficult to arrive at.—*

Here, then, the much-disputed problem of scent *v.* no scent comes to an end, and it must be confessed the matter does not terminate satisfactorily, for it leaves us with a web still unravelled, and but little that can be said to be certain one way or the other on the scent question. That a large portion of the feathered kingdom possesses some power of smelling food and also the presence of dangerous enemies seems pretty clear—he would be a bold man who denied that much—and further, that it is a power which occasionally seems to be accentuated to a marvellous degree.

But granted that birds can smell, we may safely conjecture that all species are not equally endowed with the faculty—*e. g.*, it is most unlikely that an Owl uses or requires the olfactory nerve like a Petrel, or an Ostrich in the same

\* 'Rural Sports,' vol. iii. p. 28.

ratio as a Raven. To some species smell would be an invaluable property, to others of no consequence, and most likely they do not have it, for nature does not grant her gifts where they can be of no use.

But what can it be that regulates the mystery. Does the answer lie in any particular area inhabited, in the season of the year, in the state of the atmosphere, in the physical condition of the bird itself, or in the nature of the food on which it is dependent? Here we are at a loss, and conjecture is of little avail.

*The Theory of a Food-finding Sense.*—There is another matter without some reference to which this article would be very incomplete. What I allude to is a novel theory which has been propounded more than once, and which is gaining ground, I believe—viz., that there exists in birds an occult power which may be denominated a food-finding sense, separate from and additional to the five senses commonly recognised. The principal exponent of this bold theory is a naturalist of the United States, Mr. H. H. Beck, and it must be admitted that he has made out a plausible case for what on the face of it seems a not improbable solution of many difficulties (9).

If the principle of this theory be accepted, the necessity for any employment either of scent or sight is almost done away with; the Raven is free to find its carcase, the Rook its potatoes, the Woodpecker its caterpillars, without any olfactory help at all. At the same time, if there be such a thing as a food-finding sense of this kind, it is undoubtedly safer to regard it as an adjunct to the known senses of seeing, smelling, and hearing rather than as a separate faculty.

Unquestionably Mr. Beck, in advancing his theory, is justified in laying stress on the probability of animals below man having retained some things which have been dissipated in the gradual rise of humanity; on that head he will find many to agree with him.

Thus it is quite reasonable to think that birds may have kept in a most efficient form something which human beings



either never had, or which is now lost to them. It is undeniable that a food-finding sense exists in many insects; this may be taken as established, so why not in birds, or at any rate in some birds? We must not, however, allow ourselves to be carried away by this alluring theory—a theory which has been alluded to in discussing the Vulture puzzle—to too great an extent.

As for the Vultures, I have already dwelt upon the difficulties which still beset that vexed question. The behaviour of these carrion-eating birds has long been, and still is, a matter of speculation, in spite of all which Waterton and others have written. In this connection Mr. Beck relates an incident which took place in Pennsylvania, which shall be given in his own words.

At 9 A.M. on a frosty morning, on the 1st of January, a dog, which was believed to have gone mad, was shot and thrown into a limestone sink-hole. The hole was six or seven feet deep, with an opening of about three feet, the shaft going down at an angle of 45 degrees, so that the carcase of the dog was invisible from above. Three hours after this was done Mr. Beck, who had been present when the animal was killed, returned to the sink-hole, and as he approached, two Vultures (*Cathartes*) climbed out and flapped away, having apparently been at the dog some time, for the flesh about its hams was much eaten. Here it is difficult to account for the finding of the carrion by either eye or nose, but a sixth sense, if there be such a thing, solves the difficulty at once.

We need not go far from home to find examples of behaviour very similar to what is here related of Mr. Beck's Vultures. Such are the incidents which have from time to time been put on record about the Kingfisher (*Alcedo ispida*) and our familiar Wood-pigeon (*Columba palumbus*). If a piece of water be stocked with young trout, or any small fry, most people will admit that the Kingfisher is pretty sure to find it out, yet it is hardly conceivable that the fish can be scented, although they might be seen. A case in point is furnished by Mr. J. E. Harting in his 'Birds of

Middlesex'\*. A small pond in a garden at Muswell Hill was emptied for the purpose of cleaning, but there still remained about three inches of water, and into this shallow pool there were turned by the owner four dozen very small Prussian carp. The following day a Kingfisher appeared, and continued to visit the pond daily until nearly all the little carp had vanished; yet no Kingfisher had been seen in the neighbourhood before the stocking of the pond, and none were noted by the observer, Mr. J. H. Belfrage, afterwards.

The distance to which scent can, under the most favourable circumstances, be carried by wind or any other agency has some bearing on Mr. Beck's story; but this is a point very difficult of elucidation, and scarcely comes under the category of ornithology. Macgillivray mentions an instance in which Ravens in the Hebrides appeared to have smelt carrion at a distance of six miles †. Also a somewhat similar story is related by Saxby ‡, and there are other anecdotes of much the same nature. For scent to be wafted to such great distances certainly seems extraordinary, but our knowledge at present is almost nil, so conjectures are useless.

We shall be the more ready to accept Mr. Beck's plausible theory of a food-finding sense if we remember that in birds there undoubtedly is such a thing as a homing sense. A homing sense exists in migratory birds which it is impossible to be blind to, whatever may be alleged to the contrary. Granted that birds are the possessors of marvellous vision, we may safely aver that the thousands of all sizes, from an Eagle to a Golden-crested Wren, which cross great seas, would never reach their objective year after year in the numbers they do without some aid of this kind, which is best denominated a homing sense—a something which holds migratory birds to a true course between widely separated points.

To this unconscious homing instinct a food-finding sense

\* 'Birds of Middlesex,' p. 122.

† 'History of British Birds,' i. p. 507.

‡ 'The Birds of Shetland,' p. 122; 'Zoologist,' 1864, p. 9125.

would be analogous, and if we credit one, there is no valid reason against believing the other; but there is one thing which a food-finding sense (if we grant it) would be no help in explaining—it cannot show how birds realise the presence of an enemy. Here scent must surely come into play.

*Can Birds scent one another in the breeding-season.*—There still remains one other matter connected with scent, although it turns on a very different pivot from the preceding arguments, and that is its possible connection with the mating of birds. Undoubtedly the gift of scent, although not actually needful, would be an assistance to mating in many cases, especially where species are scarce and individuals far apart, as must often happen when the usual area of distribution has been exceeded. If a Golden Oriole or a Hoopoe comes to England in May, prepared to breed, the chance of its meeting a mate is somewhat remote. If a Scops Owl or a Stilt Plover goes to Holland for the same purpose at that season it is equally unlikely that it will at once come across a partner, but given the assistance of scent and we can understand how birds comparatively far apart may be drawn together.

Sir Ray Lankester was of opinion that scent was employed in drawing the sexes to one another. "There is no doubt," he writes, "that animals of the same species are attracted to one another by smell, and that distinct species have distinct smells"\*. He is not here referring to birds, but there seems no reason why they should not be endowed in this way just as much as beasts and insects.

The singularly quick re-mating to be sometimes remarked in birds which have been widowed, purposely or accidentally, after pairing is perhaps in favour of their being able to smell one another, but then we must not overlook their acuity of sight.

Mr. George Bolam, who has had opportunities of watching many a Raven in Northumberland, is not the only naturalist who regards their speedy re-union—sometimes under the most disadvantageous circumstances—as a matter for

\* 'Diversions of a Naturalist,' p. 208.

marvel\*. It is the same with Carrion Crows. They easily get fresh mates when widowed; for instance, one of a pair was five times shot from the nest in Dumfriesshire before the last survivor deserted the familiar tree †.

Similar cases of broken partnerships replaced with noticeable—and in some cases unaccountable—celerity are remarked of several other birds—viz., of the Merlin (*Falco aesalon*) by Henry Seebohm ‡, and of *F. peregrinus* by Knox §, Gladstone ||, and Walpole-Bond ¶, and of the Hobby by Stevenson\*\*.

But the most curious case of the kind was one communicated to the 'Scotsman' of 14 February, 1914. During the previous summer a pair of Peregrine Falcons had nested at Strathmore in Sutherland. The stalker of the beat shot the male, but in a day or two his place was taken, and the stalker trapped another male. It was not long before a third appeared, and this time the stalker killed them both. It was now concluded that there was an end to the family, but not so. Two more Peregrines soon came on the scene, and successfully hatched and brought up their young in the same eyrie where the first pair had been killed.

All these cases are very curious, and different enquirers will draw different inferences from them, any one of which may be the right one. It must not be forgotten that in many Moths, and in other insects as well, the attraction which females exercise over the males has long been admitted, and the very extended flights they are known to take in consequence.

\* 'Birds of Northumberland,' p. 203.

† H. S. Gladstone *in litt*.

‡ 'History of British Birds,' i. p. 38.

§ 'Ornithological Rambles in Sussex,' p. 106.

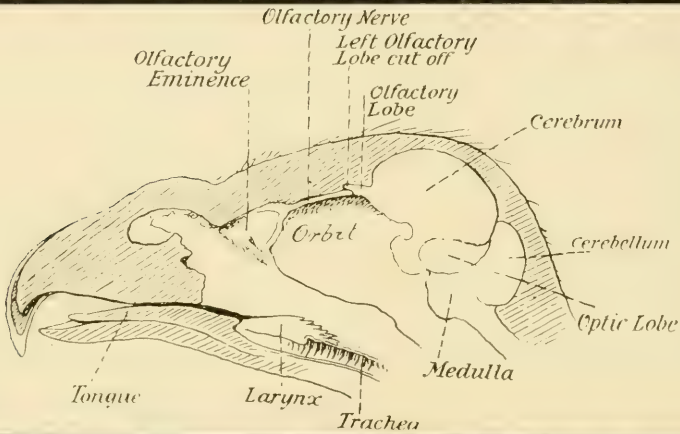
|| 'Birds of Dumfriesshire,' p. 214.

¶ 'Rarer British Birds,' p. 240.

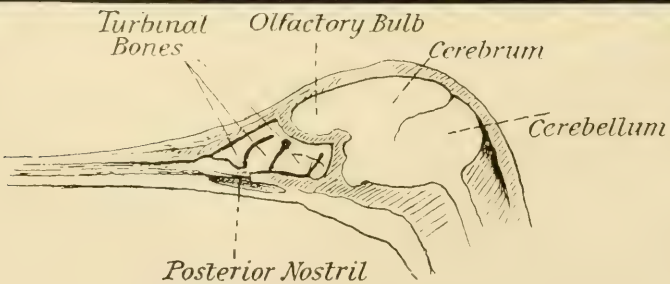
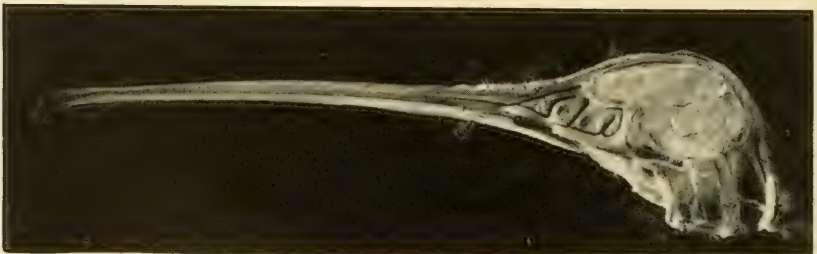
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The species, the olfactory lobes of which Dr. Strong has figured, are *Struthio camelus*, *Dromæus novæ-hollandiæ*, *Turtur risorius*, *Fulmarus glacialis*, *Machetes pugnax*, *Pseudotantalus leucocephalus*, *Leptoptilus crumeniferus*, *Phænicopterus roseus*, *Catharistes urubu*, *Circæetus gallicus*, *Chrysotis auripalliata*, *Coccyzus erythrophthalmus*, *Motacilla alba*, *Coccothraustes*, *Corvus corax*.
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1a



2

2a

Olfactory Organ and Brain of Fig. 1, AQUILA. Fig. 2, APTERYX.